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Chapter 1

Introductory Chapter: Conserving Biodiversity in Protected Areas

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http://dx.doi.org/10.5772/intechopen.73566

1. Introduction

Until recently, values and benefits from protected areas have often been taken for granted and underestimated. This book entitled *National Park: Management and Conservation* demonstrates that there are deep necessities in how the wider scientific, environmental, socioeconomic, and cultural values that these natural ecosystems provide should increasingly be recognized. The book highlights various approaches for managing and conserving protected areas to respond to some pressing global challenges today such as climate change, demand for food and energy, over exploitation, and habitat change. For this purpose, the book is published to address these issues and divided into five main sections: (1) protected area management, (2) fish and wildlife conservation, (3) biodiversity conservation, (4) ecotourism and recreation, and (5) local community participation.

The first section concentrates on challenges, constraints, and the way forward in managing protected areas with special references to Croatia, Austria, and the Czech Republic which include some pertinent issues related to transboundary cooperation. It outlines how mutual cooperation between countries can be achieved to share common responsibility in protected area management. An establishment and implementation of protected area management plan and determination of wildlife population in protected areas are highlighted in the second section of the book based on the case studies conducted in Japan and Ethiopia, respectively. Meanwhile, in Brazil, biomarkers were used to assess the exposure to environmental stress in fish population. The third section of the book outlines a progress and historical perspective over hundred years of national parks' existence in Spain since 1918. The establishment of protected areas has promoted toward more sustainable use of forest resources through biodiversity conservation and socioeconomic development. The second chapter of this section highlights the important roles of forest biomass estimated from three forest types in Malaysia

(i.e., lowland dipterocarp, hill dipterocarp, and riparian forests) in sequestering carbon as climate change mitigation. The fourth section discusses the important roles of interpretation as part of management tools for recreation in the national parks of South Africa. The next chapter discusses the growing trend of ecotourism in national parks and how it impacts the natural environment. The final section of the chapter presents the opportunities and constraints for local community involvement in protected area management in Turkey. An assessment and measurement methods to evaluate the effectiveness of stakeholder participatory process are also highlighted.

It can be summarized that the book discusses multifaceted issues pertaining the management and conservation of national parks and protected areas. The proceeding section of this introductory chapter is written on the premise that nature conservation remains the primary aim of protected areas. The chapter demonstrates that there is a profound link between the roles of protected areas and biodiversity conservation based on case studies in Malaysia. While many of protected areas are established worldwide for the conservation of particular species of interest, yet their benefits may be extended to conservation of entire biodiversity pools. In addition, biodiversity conservation, i.e., species, genetic diversity within species, and of habitats, underpins the ecosystem function of protected areas which contribute to many practical and utilitarian benefits.

2. Protected areas

Protected area refers to as geographical space, recognized, dedicated, and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values [1]. The definition of protected area is expanded into six categories. The first category is further divided into two subcategories, i.e., strict nature reserve and wilderness area. Strict nature reserve is designated for the conservation of biodiversity and geological and geomorphological features. In this reserve, visitation, use, and impacts of humans are controlled and limited to ensure that the conservation values are protected. Meanwhile, the wilderness area normally deals with large unmodified or slightly modified areas that retain their natural character and influence. To ensure that natural conditions are protected and preserved, the areas are without permanent or significant human habitation.

The second category refers to national park which consists of large and natural areas that protect large-scale ecological processes with characteristic species and ecosystem. National park also provides scientific, spiritual, educational, recreational, and visitor opportunities. The third category is identified as natural monument or feature. These areas are set aside for the protection of specific natural monuments. These include landform, sea mount, marine cavern, and ancient grove: some geological feature such as cave and living feature such as an ancient grove.

The fourth category is habitat or species management areas in which the management is prioritized to protect particular species or habitat. Active and regular interventions are required to meet the needs of particular species and habitats. In the fifth category, i.e., protected landscape and seascape, interaction of people and nature over time may produce distinct character

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of protected area which includes significant ecological, biological, cultural, and scenic value. Safeguarding integrity of this interaction is crucial to ensure the protection and sustainability of the area. The final category refers to as protected areas with sustainable use of natural resources. This involves an integration of ecosystem conservation, cultural values, and natural resource management which involve large and natural area condition. One of the aims for this category is for the use of natural resources that is compatible with nature conservation.

3. Biodiversity conservation

Biodiversity can be defined as the variety of plants, animals, and microorganisms that exist, the genes they contain, and the ecosystems they live in. It provides a variety of goods and services and supports our economy and lifestyles. Man has a moral duty to conserve it to ensure long-term sustainability for human survival and future generations. Trees are an example of critical component of biodiversity. The diversity of life that a tree can support is incredible. For example, in the tropical rainforests, a single tree can house up to 2000 different species of insects, birds, amphibians, reptiles, mammals, fungi, mosses, and epiphytic plants. Unfortunately, natural habitats everywhere are declining. Therefore, the establishment of protected area networks is essential for biodiversity conservation and thus helps to reduce its loss. As habitats are lost, we are also losing various types of precious flora and fauna. No one would have thought, even a few years ago, that some species from the families of Dipterocarpaceae, Grammitidaceae, and Begoniaceae could be extinct, but now they are. Protected areas can be used as complementary measures to achieve sustainable use of biodiversity and protect many threatened and endemic species from becoming vanished.

4. Plant conservation strategy: Malaysia's perspective

In many tropical countries throughout the world, much of the forest has lost as a result from rapid changes in land use and land cover since the last few decades. In Malaysia, for example, the changes in land use cover, particularly to agricultural land, rubber, and oil palm cultivation, are the major contributors of this conversion when the country gained independence. For example, in the 1960s, the 70% of land in Peninsular Malaysia was under natural forest cover; however, 10 years later, only 60.9% of forested area remained due to massive land development schemes during that period [2]. By 1980, the natural forest cover further declined to 49.4% (Forest Statistics, Peninsular Malaysia (1979–1985)) and has now stabilized at 44.5% since 1997 [3] as most of the land more suitable to agriculture has been cleared, leaving hilly, mountainous, and marginal lands and protected areas for wildlife sanctuaries.

Malaysia is well endowed with a great biodiversity with about 12,500–15,000 species of vascular plants [4]. A national strategy for plant conservation has been developed for the country. Part of the strategies includes a publication of *Tree Flora of Peninsular Malaysia* in four volumes since 2005 which described a total of 991 species. Meanwhile, the *Tree Flora of Sabah and Sarawak* was published in seven volumes since 1990 covering a total of 2055 species [5].

Conservation assessments of plants in Peninsular Malaysia initiated in 2005 found that 411 (42.2%) of the taxa to be in conservation concern categories from about 975 species. Based on conservation assessments of vascular plants conducted by Forest Research Institute Malaysia (FRIM), a total of 975 taxa were analyzed. The assessments consisted of families of ferns, lycophytes, gymnosperms, dicots, and monocots.

Table 1 provides a summary of possible threat that encountered by the flora from Peninsular Malaysia. In these assessments, Dipterocarpaceae represents a family for a large timber tree, Begoniaceae and Zingiberaceae represent herbs and understory plants, Nepenthaceae represents climbers, and Begoniaceae and Zingiberaceae represent ferns and lycophytes, respectively. From the assessments, it was found that four species are classified as extinct (EX), which is about 0.4% of the taxa assessed. These include *Oreogrammitis crispatula* Parris, *O. kunstleri* Parris (both are ferns from Grammitidaceae family), *Begonia eiromischa* (woolly-stalked begonia [from Begoniaceae family]), and *Shorea kuantanensis* (Meranti damar hitam [from Dipterocarpaceae family]) [5]. It was possible that the development in their habitats which involved the conversion of land cover was the cause of their extinction.

A total of 97 taxa or nearly 10% of taxa assessed were listed as critically endangered (CR) classification. Other species classified as CR categories are *D. coriaceus* (Keruing paya), *Parashorea globosa* (Gerutu pasir daun besar), and *Hopea bilitonesis*, all of which can be only found in Perak. The *D. sarawakensis* (Keruing layang) is only found in Terengganu, *H. subalata* (Merawan kanching) in Selangor, and *H. auriculata* in Johor, Pahang, and Perak. Meanwhile, 133 (13.6%) of taxa were classified as endangered (EN), 148 (15.2%) were classified as vulnerable (VU), and 29 (3.0%) were listed as rare (RA). Another 182 (18.7%) of the species were classified as near threatened (NT), 327 (33.5%) were listed as least concern (LC), and 55 (5.6%) as data deficient (DD) which means that there is insufficient information for a proper assessment of conservation status to be made. The findings for the percentage of species in each of

Conservation status	Number of taxa	Percentage (%)
Extinct (EX)	4	0.4
Critically endangered (CR)	97	10.0
Endangered (EN)	133	13.6
Vulnerable (VU)	148	15.2
Rare (RA)	29	3.0
Total conservation concern taxa	**411**	**42.2**
Near threatened (NT)	182	18.7
Least concern (LC)	327	33.5
Data deficient (DD)	55	5.6
Total	**975**	**100**

Table 1. Conservation status assessment for selected plants of Peninsular Malaysia in 2012 [5].

the conservation status category are alarming which suggest that initiatives must be made to prevent the endangered and critically endangered species from extinction. Dissemination of published information on conservation status of plants has contributed to grow a level of awareness among stakeholders.

5. Endangered species conservation

Tree species are categorized as endangered when they have limited geographic distribution, small population sizes, and specific habitat requirements. They suffered reductions in their population sizes due to over exploitation in habitats which results in loss in genetic variation within population. In Malaysia, five tree species from the family of Dipterocarpaceae, viz., *D. semivestitus* (Keruing padi), *Vatica flavida* (Resak padi), *H. apiculata* (Resak melukut), *S. hemsleyana* (Chengal pasir daun besar), and *S. macrantha* (Meranti kepong hantu), have been reported to have restricted distribution in the 12.4-ha freshwater swamp forest in part of Parit Forest Reserve at the Universiti Teknologi MARA (UiTM) campus in Seri Iskandar, Perak, Malaysia. Much of the area has been developed into urban settlements leaving small fragments of isolated forests in the area. An ongoing study is conducted to determine the demographic structure of the five endangered species and to map the spatial distribution of the five species [6, 7]. UiTM in collaboration with FRIM monitors the physiology and phenology of trees in the area.

A geographic information system (GIS) was used to analyze the geographic distribution of the endangered species. This was done by overlying the spatial location of endangered species onto the image of habitat areas. The purpose is not only to visualize the present data but also to analyze how the trees are spatially distributed in the landscape. This will allow the researchers to address a critical issue in monitoring the endangered species and in identifying priorities for protected area management with regard to boundaries of reserves.

The spatial distribution of five endangered species is shown in **Figure 1**. From the map, the distribution of four species, i.e., *D. semivestitus*, *S. macrantha*, *H. apiculata*, and *V. flavida*, in the landscape is appeared to be spatially dispersed. However, the spatial distribution of *S. hemsleyana* appears to be more localized compared to other species. It is important to note that many of the species appear to be located at the forest edges. Forest edges are prone to disturbance and experience more dramatic environmental changes. For instance, wind and sun dry out the forest edges which results in elimination of water sources for this sensitive habitat of freshwater swamp forest. Forest edges are also more exposed to vegetation clearing and urban development. Therefore, to address the further decline of biodiversity of tree species, it is essential that conservation plan be incorporated in the campus development plan and more efforts be undertaken to conserve the threatened habitat and species.

From the field survey, for *S. hemsleyana* the highest number of individuals discovered in the study area is recorded (i.e., 198), followed by *D. semivestitus* (35), *S. macrantha* (24), *H. apiculata*, (14) and *V. flavida* (6) (**Table 2**). For *D. semivestitus*, the number of individuals found has reduced from what was previously reported. Chua et al. [8] earlier reported that a total of 53 trees were

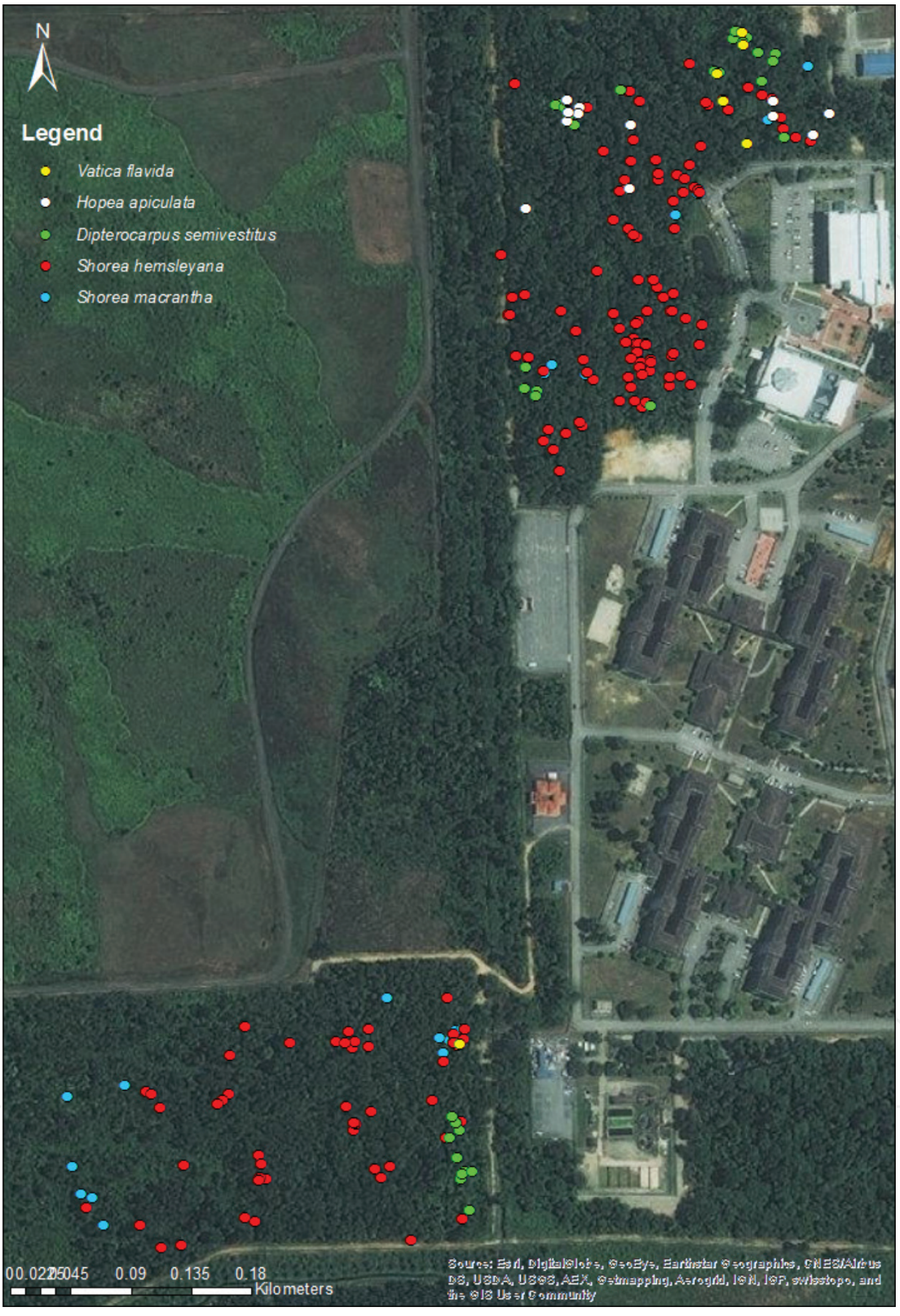

Figure 1. Spatial distribution of five critically endangered species of Dipterocarpaceae at freshwater swamp forest of Parit Forest Reserve, UiTM, Seri Iskandar, Perak, Malaysia [6, 7].

Tree species	Number of individual	Malaysia Red List categories*	Malaysia Red List criteria*
D. semivestitus	35	CR	A4bc, C1
V. flavida	6	CR	A4c, B2ab(ii)
H. apiculata	14	EN	B1b(iii) + c(ii)
S. hemsleyana	198	CR	A4c, D2
S. macrantha	24	EN	B1b(iii) + c(ii)

Notes: CR, critically endangered; EN, endangered

*Based on Chua et al. [8]

Table 2. Conservation status assessment for five endangered species in the freshwater swamp forest of Parit Forest Reserve, UiTM, Seri Iskandar Campus, Perak, Malaysia [6, 7].

located in this area. The loss of 18 *D. semivestitus* individuals was due to an illegal logging in the area which took place in 2012 and lightning strike in May 2014. Historical records reported that the species grows on in two places, Parit Forest Reserve (the study location) and Murabahah district, Central Kalimantan, Indonesia [9]. However, the population in Kalimantan has gone extinct as the area has been converted into oil palm plantations. Therefore, the freshwater swamp forest in Parit Forest Reserve is likely the last population in the world.

As one of 12th mega diversity countries, Malaysia is the home to the most endangered species in the world. The list of threatened species of Dipterocarpaceae has been initiated for Malaysia with a publication of the *Malaysia Plant Red List* [8]. The list has the most comprehensive national threatened tree species under this family thus far, and the first of such is prepared by the Malaysian botanists working together. This Red List is used to classify Peninsular Malaysian Dipterocarpaceae species at high risk of extinction for an assessment at the national level. It covers dipterocarp taxa that are indigenous to Peninsular Malaysia and taxa that are common to the Peninsula and East Malaysia (i.e., Sabah and Sarawak). Based on the *Malaysia Plant Red List*, of the five species, *D. semivestitus*, *V. flavida*, and *S. hemsleyana* are categorized as CR, whereas *H. apiculata* and *S. macrantha* are classified as EN (**Table 2**). Nevertheless, all five species discovered at freshwater swamp forests of Parit Forest Reserve, Perak, are rare and threatened species.

6. Conclusion

In view of the decline in the population of endangered species, conservation measures for the species are urgently needed. Involving stakeholders and local communities in biodiversity conservation efforts can be the key success of a project. This can be achieved by raising awareness of the public and policy makers. The commitments and efforts of stakeholders to support the monitoring and maintenance of ex situ collection are particularly crucial for species that occur on the private land, as demonstrated in the abovementioned case study.

The establishment of protected areas is extremely important in particular for endangered species and sensitive habitats and should be included as one of the key issues of sustainable development elsewhere. However, they need to be better located and actively managed to deal with problems of such as illegal logging, human settlements, unsustainable tourism, encroachment, and challenges in climate change. Unfortunately, in some countries, the protected areas are managed by different networks and governed by different laws with varying degrees of protection status. Therefore, each country should establish uniform national protected areas system operating in the country. Regardless of values and benefits of protected areas, implementation of effective management and conservation strategies aimed at maintaining or restoring these benefits are deemed necessary.

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